

# Optimized Wavelength-tuned Nonlinear Frequency Conversion

Completed Technology Project (2016 - 2017)



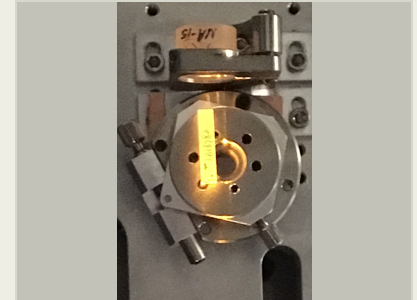
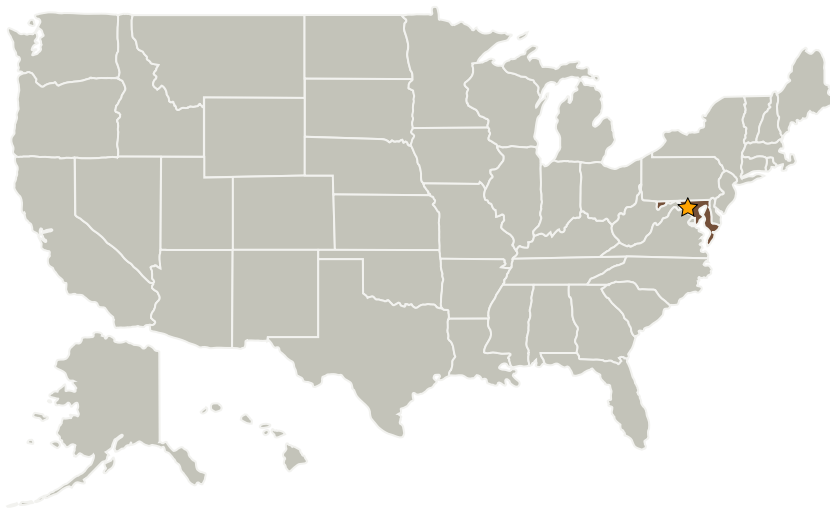
## Project Introduction

Efficient nonlinear optical conversion requires a precise phase-matching condition. Due to optical dispersion (light having a different index of refraction for different wavelengths), the phase-matching condition is only maintained over a narrow wavelength band. Generally temperature- or angle-tuning of the nonlinear crystal is required to maintain phase-matching during wavelength-tuning. We will explore a novel technique to tune the phase-matching condition and thus extend the range over which light can be efficiently converted.

## Anticipated Benefits

There are numerous spectroscopic applications both in and out of NASA that require wavelength-tunable laser sources. These include differential optical absorption spectroscopy instruments for methane, carbon dioxide, water vapor, oxygen, etc. and various in-situ spectrometers.

## Primary U.S. Work Locations and Key Partners



Example of nonlinear optical crystal

## Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Links	3
Project Website:	3
Technology Areas	3
Target Destinations	3

Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

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## Primary U.S. Work Locations

Maryland

## Project Transitions

**October 2016:** Project Start**September 2017:** Closed out

**Closeout Summary:** The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services. Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry. The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies. If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. <http://techport.nasa.gov/help>

## Organizational Responsibility

**Responsible Mission Directorate:**

Mission Support Directorate (MSD)

**Lead Center / Facility:**

Goddard Space Flight Center (GSFC)

**Responsible Program:**

Center Independent Research &amp; Development: GSFC IRAD

## Project Management

**Program Manager:**

Peter M Hughes

**Project Managers:**

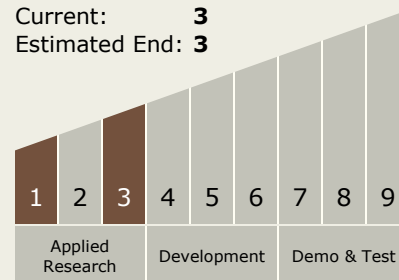
Terence A Doiron

Michael A Johnson

**Principal Investigator:**

Mark A Stephen

## Technology Maturity (TRL)

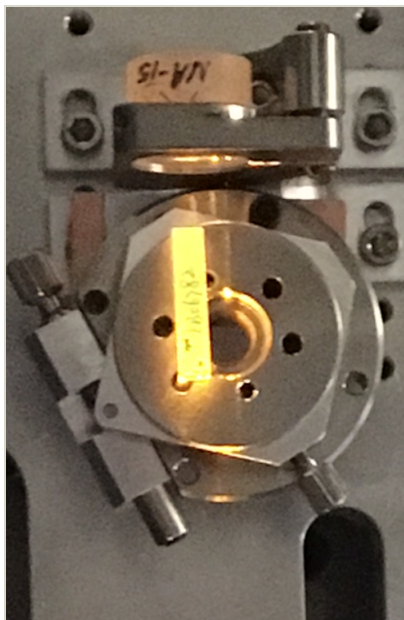
Start: **1**Current: **3**Estimated End: **3**

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## Images



### Wavelength conversion crystal

Example of nonlinear optical crystal  
(<https://techport.nasa.gov/image/26358>)

## Links

GSC-17788-1  
(no url provided)

### Project Website:

<http://aetd.gsfc.nasa.gov/>

## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
  - └ TX08.1.5 Lasers

## Target Destinations

Foundational Knowledge, Earth,  
Others Inside the Solar System